Assignment 2

Descriptive Statistics; Statistical Inference

Textbook Assignment: Chapters 3 and 4

● Make the following changes in your textbook:

In the last line (left column), page 63, insert: "per squadron" between "failures" and "requiring".

In the right column, page 64, and the left column, page 65, replace the example given with the following:

EXAMPLE: If the probability of a defective item is 0.2 and we use a sample of 500 items from a large population, what is the probability of 120 or more defective items?

SOLUTION: Write

$$\mu = np$$
$$= 500\ (.2)$$
$$= 100$$

and $\sigma = \sqrt{npq}$

$$= \sqrt{500\ (0.2)(0.8)}$$

$$= \sqrt{80}$$

$$= 8.9$$

Then,

$$z = \frac{x - \mu}{\sigma}$$

$$= \frac{119.5 - 100}{8.9} = \frac{19.5}{8.9} = 2.19$$

Using table 4-1 find that the probability

$$P\{z > 2.19\} = 0.5000 - 0.4857$$

$$= 0.0143$$

In this same example, what is the probability of exactly 120 defective items? Since the probability of more than 120 defective items in the binomial distribution is the same as 120.5 defective items in the normal distribution we use x equal to 120.5 (again, this is due to the binomial being a discrete distribution). Then

$$\mu = 100$$
$$x = 120.5$$
$$\sigma = 8.9$$

and we write

$$z = \frac{120.5 - 100}{8.9} = \frac{20.5}{8.9} = 2.30$$

Using table 4-1 find that

$$P\{z > 2.3\} = 0.5000 - 0.4893$$

$$= 0.0107$$

The probability of exactly 120 defective items is

$$P\{2.19 < z < 2.3\} = 0.0143 - 0.0107$$

$$= 0.0036$$

The preceding example is illustrated in figure 4-7.

Delete figure 4-7 on page 65 and refer to figure 4-7 below.

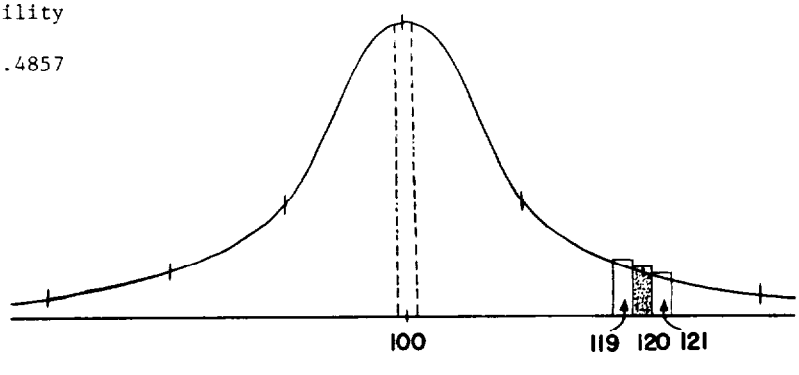


Figure 4-7.--Normal curve (x = 120.5)

Learning Objective:

Identify some basic terms and methods associated with statistical data and its graphical representation.

2-1. What term is given to the grades 90, 85, 80, 80, 75, and 70?
1. Frequency
2. Frequency distribution
3. Class interval
4. Ordered array

2-2. What is the frequency of 82, in the set of numbers 85, 82, 82, 78, 78, 82, and 80?
1. 1
2. 2
3. 3
4. 7

2-3. What is the class interval if 2 classes are desired of the grades 88, 90, 85, 80, and 92?
1. 2
2. 4
3. 5
4. 6

● In answering items 2-4 through 2-6 refer to the frequency polygons in Figure 2A. NOTE: Assume IQ's to be integers.

2-4. How many first grade children are represented by the frequency polygon for school A.
1. 25
2. 26
3. 27
4. 28

2-5. For the samples represented, the child with the highest IQ attends school
1. A
2. B

2-6. The sample from school A has how many more children with IQ's between 109.5 and 149.5 than does the sample from school B?
1. 1
2. 2
3. 3
4. 4

Learning Objective:

Given statistical data, determine measures of central tendency by calculating arithmetic mean, deviation, median, mode, range, and geometric and harmonic means.

2-7. Calculate the mean of the numbers 16, 32, 24, 25, 20, 35, and 30.
1. 26
2. 28
3. 30
4. 32

2-8. What does the symbol $\bar{X}$ represent in statistics?
1. Frequency
2. Mean
3. Mode
4. Number

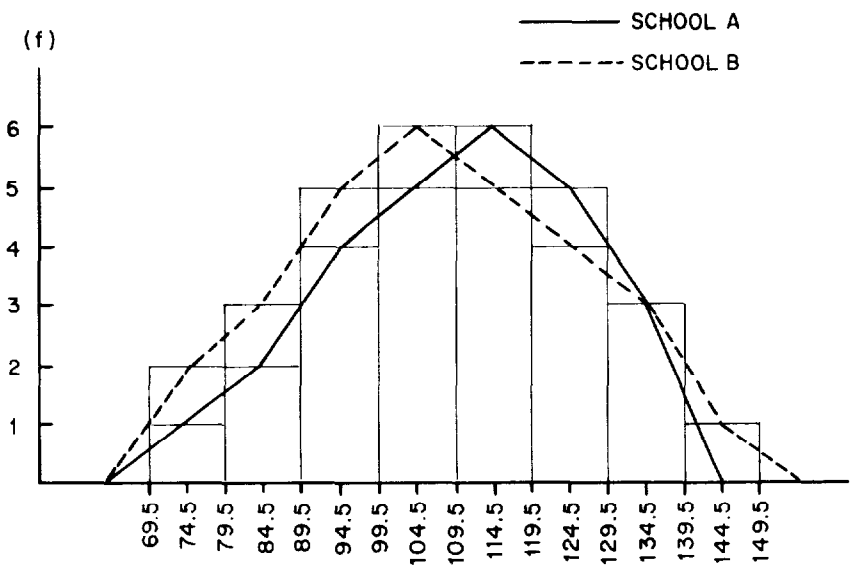


Figure 2A.--Distribution of IQ's for first grade children in two suburban schools.

2-9. What is $f(x_i)$ of 51 in the set of numbers 60, 51, 60, 49, 51, 55, 55, 60, and 51?
1. 51
2. 56
3. 102
4. 153

2-10: What is the mean of the deviations of the numbers 87, 84, 85, 82, 78, 72, and 80 if the assumed mean is 82?
1. -0.10
2. -0.25
3. -0.42
4. -0.86

2-11: Calculate the actual mean of the values 60, 62, 71, 64, 82, and 90 if the assumed mean is 71?
1. 68.8
2. 71.5
3. 73.8
4. 74.7

● Use the following partially completed coded frequency distribution table in answering items 2-12 through 2-16.

Class Boundaries	Freq. f	Class marks x	Code u	(Code)(Freq) uf
211.7 - 221.7	3			
221.7 - 231.7	8			
231.7 - 241.7	11	236.7		
241.7 - 251.7	21		-1	
251.7 - 261.7	21		0	
261.7 - 271.7	13			
271.7 - 281.7	9			
281.7 - 291.7	2			

Table 2A.--Incomplete coded frequency distribution.

2-12. What is the value of $\sum_{i=1}^{n} f_i$?
1. 8
2. 21
3. 60
4. 88

2-13. What is u_i of the class interval 211.7 - 221.7?
1. 4
2. -2
3. -3
4. -4

2-14. What is the value of C?
1. -4
2. 1
3. 8
4. 10

2-15. Calculate the value of $\sum_{i=1}^{n} u_i f_i$.
1. -79
2. -42
3. 8
4. 142

2-16. What is the value of $\bar{x}$?
1. 251.93
2. 253.16
3. 254.37
4. 256.70

2-17. Determine the median of the data 8, 2, 7, 5, 8, 6 and 9.
1. 5
2. 6
3. 7
4. 8

2-18. Find the median of the data 1, 3, 9, 5, 7, and 1.
1. 1
2. 3
3. 4
4. 4.5

2-19. Select the statement below that is correct relative to the data 25, 30, 43, 43, 46, and 36.
1. The range equals 21.
2. The mean equals 38.
3. The mode equals 46.
4. The median equals 44.

2-20. Select the statement below that is correct relative to the data 17.3, 21.7, 21.7, 16.9, 18.1, 25.5, and 23.3.
1. The range equals 9.2.
2. The mean equals 21.3.
3. The mode equals 21.7.
4. The median equals 23.3.

2-21. Select the statement below that is correct relative to the data 42.3, 42.3, 37.5, 38.0, 46.9, 44.4, and 58.7.
1. The range equals 9.4.
2. The median equals 38.0.
3. The mean equals 44.3.
4. The mode equals 46.9.

2-22. Find the geometric mean if the log values of the items are 1.8142, 1.7293, 2.0180, 1.6198, 1.2920, and 2.2451.
1. Antilog 1.7864
2. Antilog 2.0164
3. Antilog 2.8192
4. Antilog 10.7184

2-23. If a ship travels 40 nautical miles at 30 knots and the next 40 nautical miles at 8 knots, what is the average speed of the ship?
1. 12.6 knots
2. 13.4 knots
3. 14.8 knots
4. 19.0 knots

2-24. A destroyer traveled 25 nautical miles at 20 knots, the next 25 nautical miles at 10 knots and the last 25 nautical miles at 30 knots. What was the average speed of the destroyer?
1. 22.6 knots
2. 20.0 knots
3. 18.2 knots
4. 16.4 knots

Learning Objective:

Given statistical data, determine measures of variability by calculating mean and standard deviations.

● Find the mean deviation for the given data in items 2-25 through 2-27.

2-25. Data: 8, 10, 12, 20, 17, 23.
1. 3.67
2. 5.00
3. 7.80
4. 15.00

2-26. Data: 2, 6, 3, 5, 7.
1. 1.68
2. 2.34
3. 3.68
4. 4.84

2-27. Data 8, 8, 10, 8, 10, 9, 11, 12, 7.
1. 1.11
2. 1.18
3. 1.36
4. 1.54

2-28. What does $\sum_{i=1}^{n} (x_i - \bar{x})^2$ equal in the set of data 4, 7, 3, 3, and 5?
1. 6.80
2. 8.96
3. 10.42
4. 11.20

2-29. By using the formula for s, determine the standard deviation of the data 20, 22, 24, 26, and 28.
1. 10.00
2. 7.94
3. 6.28
4. 3.16

2-30. By using the formula for s, determine the standard deviation of the values 43, 45, 45, 46, 45, 44, 45, and 47.
1. 1.1
2. 1.2
3. 1.3
4. 1.4

● In answering items 2-31 through 2-33, use coding, the formula

$s = C\sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (u_i - \bar{u})^2 f_i}$, and the following data:

70, 60, 80, 90, 80, 70, 80, 50, 90, 60.

(u_i of 70 equals 0).

NOTE:

If your answer to either item 2-31 or item 2-34 is opposite in sign of the alternative you believe to be correct, this is due to the fact that the "u" values may be assigned to the "X" values in two possible ways. Either way is correct. Choose the alternative in each item which is the same or opposite in sign of your answer as the correct answer and answer the remaining items based on your original tabulations.

2-31. Find $\bar{u}$.
1. 0
2. -0.3
3. -1.3
4. -2.2

2-32. Calculate $\sum_{i=1}^{n} (u_i - \bar{u})^2 f_i$.

1. 16.10
2. 20.12
3. 25.43
4. 27.22

2-33. What is the standard deviation of the data?
1. 9.6
2. 11.4
3. 13.4
4. 15.2

● In answering items 2-34 through 2-36, use the formula

$s = C\sqrt{\frac{1}{n-1} \left[\sum_{i=1}^{n} u_i^2 f_i - \frac{1}{n} \left(\sum_{i=1}^{n} u_i f_i \right)^2 \right]}$

and the data: 70, 80, 80, 70, 80, 60, 80, 90, 70, 50, (u_i of 70 = 0).

2-34. Find $\sum_{i=1}^{n} u_i f_i$.
1. 4
2. 1
3. 0
4. -3

2-35. What does $\sum_{i=1}^{n} u_i^2 f_i$ equal?

1. 13
2. 5
3. 1
4. -3

2-36. Determine the standard deviation using the given data.

1. 5.4
2. 9.2
3. 11.6
4. 13.6

● In answering items 2-37 and 2-38 use the formula $s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$ and the values 80, 90, 90, 80, 70, 60, 80:

2-37. Find Σx^2 for the data:

1. 32,400
2. 35,600
3. 40,000
4. 43,900

2-38. What is the standard deviation of the data?

1. 9.8
2. 10.7
3. 11.4
4. 13.5

Learning Objective:

Discriminate between mathematical combinations and permutations and solve problems involving these two concepts.

2-39. If the watch bill consisting of 6 sailors is to be chosen from a group of 12 sailors, in how many different combinations can the watch bill be selected?

1. 6
2. 120
3. 432
4. 924

2-40. A mess cook interested in using some leftover meats and vegetables decides to make a stew consisting of three kinds of meats and five vegetables. If there are five different meats and eight different vegetables available, how many different kinds of stews can the cook make?

1. 40
2. 120
3. 560
4. 600

2-41. In how many different ways can you appoint a president and a vice president in a club containing 10 members?

1. 20
2. 45
3. 90
4. 720

Learning Objective:

Solve probability problems involving mutually exclusive and dependent events, and determine the applicability of binomial distribution.

2-42. Of twelve sailors in a group, seven are firemen, three are seamen, and two are airmen. One of the men is selected at random for a special work detail. What is the probability that a fireman will be selected?

1. $\frac{1}{12}$
2. $\frac{1}{3}$
3. $\frac{1}{2}$
4. $\frac{7}{12}$

2-43. What is the probability of a four, a three, or a one showing face up if a die is tossed?

1. $\frac{1}{6}$
2. $\frac{1}{4}$
3. $\frac{1}{3}$
4. $\frac{1}{2}$

2-44. If a card is drawn from a standard deck of 52 cards which contains four aces, and a second card is drawn from the remaining cards, what is the probability that both cards are aces?

1. $\frac{1}{13}$
2. $\frac{1}{52}$
3. $\frac{1}{169}$
4. $\frac{1}{221}$

2-45. An urn contains five blue and eight white marbles. Two marbles are drawn successively from the urn, the first being returned before the drawing of the second. What is the probability that both marbles are the same color?

1. $\frac{25}{169}$

2. $\frac{64}{169}$

3. $\frac{75}{169}$

4. $\frac{89}{169}$

2-46. The probability of HHHH on four tosses of a coin is

1. $\frac{1}{8}$

2. $\frac{1}{10}$

3. $\frac{1}{12}$

4. $\frac{1}{16}$

2-47. What is the probability of a six showing only once in four tosses of a die?

1. $\frac{2}{3}$

2. $\frac{19}{54}$

3. $\frac{47}{108}$

4. $\frac{125}{324}$

2-48. Find the probability of at least three sixes showing in the roll of four dice. (Four dice rolled simultaneously is the same as one die thrown four times.)

1. $\frac{5}{324}$

2. $\frac{6}{324}$

3. $\frac{7}{432}$

4. $\frac{57}{432}$

2-49. What is the probability of two fives showing if four dice are rolled simultaneously? (Four dice rolled simultaneously is the same as one die rolled four times.)

1. $\frac{1}{3}$

2. $\frac{25}{216}$

3. $\frac{30}{216}$

4. $\frac{150}{216}$

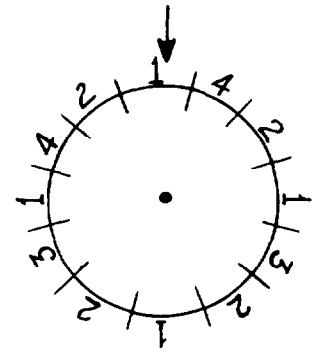
2-50. What is the probability that a two will come up less than three times on five spins of the roulette wheel shown below?

1. $\frac{7}{9}$

2. $\frac{64}{81}$

3. $\frac{99}{243}$

4. $\frac{211}{243}$



2-51 From a standard deck of 52 cards, a card is drawn at random; a second card is then drawn without the first card having been replaced. Why does the binomial distribution not apply?
1. The number of trials must be fixed.
2. The probability of successes must be identified.
3. Each trial must result in either a success or a failure.
4. All of the trials must be independent.

Learning Objective:

Find areas under normal curves by using a table of areas.

● Refer to table 4-1 in your text in answering items 2-52 through 2-55

2-52 Find the area under a curve from z equals 0.8 to z equals 1.2.
1. 0.0968
2. 0.1617
3. 0.2435
4. 0.6730

2-53. Find the area under a curve from z equals -0.9 to z equals 1.7.
1. 0.1395
2. 0.4557
3. 0.5334
4. 0.7713

2-54. What is the area between x equals 82 and x equals 91 if the mean is 85 and the deviation is 4? (Assume a normal distribution.)
1. 0.7066
2. 0.7211
3. 0.7632
4. 0.7845

2-55. If a set of grades has a mean of 78 and a standard deviation of 5, what is the probability that a grade selected at random will be higher than 86? (Assume a normal distribution.)
1. 0.2124
2. 0.1020
3. 0.0862
4. 0.0548

Learning Objective:

Identify requirements for and solve problems using the Poisson formula of probability and the distribution table.

2-56. Which of the following is not a requirement for Poisson's formula of probability?
1. The average or mean must remain constant
2. The number of possible occurrences in any unit is large.
3. The particular occurrences in one unit do not influence the particular occurrences in another unit.
4. The probability of a particular occurrence is large.

2-57. A boiler has been breaking down on the average of three times per month. By the use of Poisson's probability formula, what is the probability that the boiler will break down only one time in a given month?
1. 0.134
2. 0.152
3. 0.169
4. 0.184

● Refer to table 4-2 in your textbook in answering items 2-53 and 2-59

2-58. If sailors randomly enter the mess hall on the average of 1.2 every 10 seconds, what is the probability of four sailors entering the mess hall in a selected 10-second period?
1. 0.022
2. 0.026
3. 0.089
4. 0.126

2-59. A certain type altimeter averages 0.80 failures per week. What is the probability that more than 2 altimeters will be broken in a given week?
1. 0.047
2. 0.078
3. 0.110
4. 0.129

Learning Objective:

Identify and use normal to binominal approximation in solving probability problems.

2-60. Which of the following equations may use the normal to approximate the binomial?
1. $np = 1$
2. $np < 3$
3. $np < 5$
4. $np = 7$

2-61. Which of the following is not a step in using the normal to approximate the binomial?
1. $np = \mu$
2. $\sqrt{npq} = \sigma$
3. Use the normal table
4. To find more successes, add 0.5 to x

● Refer to table 4-1 in your textbook in answering items 2-62 through 2-64.

2-62. If the probability of a defective item is 0.10 and a sample of 400 items is taken from a large population, what is the probability of 28 or less defective items?
1. 0.0274
2. 0.1250
3. 0.2020
4. 0.4545

2-63. If the probability of a defective item is 0.1 and a sample of 900 out of a large population is used, what is the probability of exactly 102 defective items?
1. 0.0090
2. 0.0180
3. 0.0142
4. 0.0211

2-64. If the probability of a success in one try is $\frac{1}{4}$ what is the probability of at least 17 successes in 48 tries?
1. 0.3333
2. 0.1542
3. 0.0932
4. 0.0668

2-65. Refer to table 4-3 in your text. A set of data which is normally distributed has a mean of 82 and standard deviation of 5. Find the range of the data that will cover an area of 0.807.
1. 86.5 and 77.5
2. 87.5 and 76.5
3. 88.5 and 75.5
4. 89.5 and 74.5

2-66. If the raw scores on an examination are 83, 88, 85, 90, and 94, the standard score of the raw score 90 equals
1. 0.34
2. 0.46
3. 0.61
4. 1.12

2-67. Change a standard score of 2.8 to a corrected standard score with a mean of 100 and a standard deviation of 10.
1. 112
2. 128
3. 142
4. 156

Learning Objective:

Solve problems involving random sampling.

2-68. From a sample size of 121, solve for the standard error of the mean if the standard deviation equals 5.
1. $\pm$.04
2. $\pm$.21
3. $\pm$.45
4. $\pm$.89

2-69. For a given confidence level, if the mean and standard deviation of a sample remain the same as the size of the sample greatly increases, the size of the confidence interval (range about the mean) will
1. increase
2. decrease
3. remain the same

2-70. A random sample of 144 students had a mean grade of 79 and a standard deviation of 4 on a standard test. What range about the mean will give an 8 percent confidence level?
1. 79.43 and 78.57
2. 79.58 and 78.42
3. 79.67 and 78.33
4. 79.73 and 78.27